

Attachment 9 Stormwater Flood Management Grant Proposal City of Redwood City Water Quality and Other Expected Benefits

Attachment 9 consists of the following items:

- ✓ **Water Quality and Other Expected Benefits.** Attachment 9 provides estimates for the water quality and other expected benefits of the proposed project.
- ✓ **Appendix 9-1.** Appendix 9-1 of this attachment contains information regarding the qualitative and quantitative water quality and other benefits of the proposed project.

Introduction

The attachment provided information regarding benefits that may be derived from this project and which extend beyond the flood damage reduction costs and benefits described in Attachment 7 or the water supply benefits described in Attachment 8.

The section contains a narrative description of the expected water quality and other benefits of the project. Where possible, each benefit was quantified and presented in physical or economic terms. In cases where quantitative analysis was not feasible, this attachment provides complimentary qualitative analyses. In addition, this attachment provides a description of economic factors that may affect or qualify the amount of economic benefits to be realized. This attachment also includes a discussion regarding uncertainties about the future that might affect the level of benefit received. Appendix 9-1 contains detailed information regarding the benefits anticipated to occur as a result of this proposal.

Benefits

The water quality and other benefits that are anticipated to result from implementation of this project are summarized in Table 9-1, and the cost-benefit overview is summarized in Table 9-2. Detailed cost and benefit information associated with the project, including present value calculations, is provided in Appendix 9-1.

Table 9-1: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Water Quality and Other Benefits		
Reduced Potential for Sewer Overflows	Qualitative	Local and Regional
Reduced Sediment Loading into SF Bay	Qualitative	Local and Regional
Avoided Debris Cleanup	Monetized	Local
Avoided Public Safety Expenses	Monetized	Local

Table 9-2: Benefits-Cost Analysis Overview

	Present Value (\$2009)
Costs – Total Capital and O&M	\$12,715,552
Monetizable Benefits	
Avoided Debris Cleanup	\$1,210,369
Avoided Public Safety Expenses	\$307,989
Qualitative Benefits	Qualitative Indicator*
Reduced Potential for Sewer Overflows	+
Reduced Sediment Loading into SF Bay	+

*Magnitude of effect on net benefits

+/- (negligible or unknown); + (moderate positive); ++ (significant positive); - (moderate negative); -- (significant negative)

The “Without Project” Baseline

If the proposed project were not implemented, there would continue to be the risk of sanitary sewer overflows and continued sediment loading. Additionally, there would be no benefit received from avoided flood damages.

Water Quality and Other Benefits

The project would provide several water quality and other expected benefits. These benefits are described in detail below and are summarized in Table 9-1.

Reduced Potential for Sewer Overflows

The proposed project would reduce flooding in the residential and commercial areas surrounding the Bayfront Canal. These areas have a sanitary sewer system that is managed by the Fair Oaks Sewer Maintenance District. Although the District adopted a Sanitary Sewer Master Plan, which was updated in 2009 and includes measures to control inflow and infiltration, no sewer district can eliminate all inflow and infiltration. This project limits the potential for inflow and infiltration by reducing flooding, thus reducing inflow, and reducing the saturation of the ground, thus reducing infiltration.

Inflow and infiltration can lead to a sanitary sewer overflow (SSO), which is any overflow, spill, release, discharge or diversion of untreated or partially treated wastewater from a sanitary sewer system. SSOs often contain high levels of suspended solids, pathogenic organisms, toxic pollutants, nutrients, oil, and grease. SSOs pollute surface and ground waters, threaten public health, adversely affect aquatic life, and impair the recreational use and aesthetic enjoyment of surface waters. Typical consequences of SSOs include the closure of beaches and other recreational areas, inundated properties, and polluted rivers and streams.

Reduced Sediment Loading into San Francisco Bay

The Bayfront Canal drains to the San Francisco Bay. By installing the floodwall on the property side of the canal, this project will allow for increase tidal flow between the canal and the adjoining Flood Slough. This increased tidal flow would allow for deposition of sediment into the canal, which has an earthen bottom, and is anticipated to reduce the sediment loading to the Flood Slough, which ultimately feeds to the San Francisco Bay.

Sediment is made up of loose particles of clay, silt and sand. It is a natural part of stream and bay, created by the weathering of rocks and soil. Sediments, however, when out of balance, may serve as a repository for contaminants. Concern about sediment contamination in the San Francisco Bay Area and grows as more information on the potential adverse effects of sediment contamination. NOAA's Office of Response and Restoration (OR&R) identifies the following concerns associated with sediment loading in San Francisco Bay:

- Various toxic contaminants found only in barely detectable amounts in the water column can accumulate in sediments to much higher levels;

- Sediments serve as both a reservoir for contaminants and a source of contaminants to the water column and organisms;
- Sediments integrate contaminant concentrations over time, whereas water-column contaminant concentrations are much more variable and dynamic;
- Sediment contaminants (in addition to water column contaminants) affect bottom-dwelling organisms and other sediment-associated organisms, as well as both the organisms that feed on them and humans; and
- Sediments are an integral part of the aquatic environment that provide habitat, feeding, spawning, and rearing areas for many aquatic organisms (EPA 1996).

Avoided Debris Cleanup

The flooding associated with chronic and persistent flooding results in public response every two years (Bayfront Canal Improvement Project Report, Winzler & Kelly, 2003). As a result, public works crews must respond within the City of Redwood City, the City of Menlo Park, and unincorporated areas of San Mateo County. Based on historical flooding events, this response is typically during a 2-day storm event and for a 5-day period after each storm event. Based on wage data for public works employees, the crew size necessary to respond to the affected area, and the equipment necessary to aid in the response, an estimated \$214,863 (\$2009) is spent on debris cleanup per storm event. These costs are summarized in Table 9-3. The net present value of this avoided cost after project completion is \$1,210,369.

Table 9-3: Avoided Debris Cleanup Costs Associated with 2-year Storm Event

Activity	Duration	Cost (\$2009)
Response during storm event	2 days	\$88,303
Response after storm event	5 days	\$126,560
Total		\$214,863

Avoided Public Safety Expenses

The flooding associated with chronic and persistent flooding results in public response every two years (Bayfront Canal Improvement Project Report, Winzler & Kelly, 2003). As a result, public safety employees must respond within the City of Redwood City, the City of Menlo Park, and unincorporated areas of San Mateo County. Based on historical flooding events, this response is typically during a 2-day storm event. Based on wage data for public employees, an estimated \$54,674 (\$2009) is spent on public safety per storm event. These costs are summarized in Table 9-4. The net present value of this avoided cost after project completion is \$307,989.

Table 9-4: Avoided Public Safety Costs Associated with 2-year Storm Event

Activity	Duration	Cost (\$2009)
Response during storm event	2 days	\$54,674
Total		\$54,674

Detailed cost and benefit information associated with the project, including present value calculations, is provided in Appendix 7-1.

Distribution of Benefits and Identification of Beneficiaries

Table 9-5 summarizes the anticipated beneficiaries of water quality benefits that would be provided by the proposed project. The water quality and other improvements would benefit local and regional stakeholders.

Table 9-5: Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Water Quality and Other Benefits		
Reduced potential for sewer overflows	Qualitative	Local and Regional
Reduced sediment loading into SF Bay	Qualitative	Local and Regional

Project Benefits Timeline Description

Water quality and other expected benefits would occur over a timeline relative to the probability of various hydrologic events. Therefore, this project would accrue avoided cost of response benefits due to 2-year storm events.

Potential Adverse Effects from the Project

Any potential short-term impacts associated with this project will be addressed and mitigated during the CEQA compliance process. No long-term adverse effects are expected as a result of this project.

Uncertainty of Benefits

Uncertainties relating to the water quality and other expected benefits of this project are summarized below in Table 9-6. As shown in the table below, uncertainties regarding water quality and other expected benefits would occur because specific information on the sediment loading or sewer overflows associated with the current conditions is unknown and avoided costs are estimated based on previous storm events.

Table 9-6: Omissions, Biases, and Uncertainties and their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits	Comment
Reduced Potential for Sewer Overflows	+/-	There are no documented sewer overflows as a result of inflow and infiltration, so this benefit was based on the potential for sewer overflows.
Reduced Sediment Loading into SF Bay	+/-	Although SF Bay is not listed as a 303d water body for sediment, NOAA has still identified sediment as a concern for this water body. The reduced sediment loading would provide benefits.
Avoided Debris Cleanup	+	Benefit is likely to have a moderate positive benefit through reduced costs associated with debris cleanup during and after storm events.
Avoided Public Safety Expenses	+	Benefit is likely to have a moderate positive benefit through reduced costs associated with public safety during storm events.

*Magnitude of effect on net benefits

+/- (negligible or unknown); + (moderate); ++ (significant positive); - (moderate negative); -- (significant negative)

Appendix 9-1: Economic Analysis Tables

Table 19 – Water Quality and Other Expected Benefits	Attached
Table 20 – Proposal Project Costs and Benefits Summary for Proposition 1E	Attached

Table 19 - Water Quality and Other Expected Benefits (2009 dollars)
Project: Bayfront Regional Drainage System Improvements and 5th Avenue Pump Station Renovation Project

(a) Year	(b) Type of Benefit: Avoided Costs of Debris Cleanup					(b) Type of Benefit: Avoided Cost of Safety Personnel					Discounting Calculations for Economic Benefits		
	(C) Measure of Benefit [Unit]: per 2-year event (2-day storm, 5-day clear					(C) Measure of Benefit [Unit]: per 2-year event (2-day storm)							
	(d) Without Project	(e) With Project	(f) Change Resulting from Project [e - d]	(g) Unit \$ Value	(h) Annual \$ Value [f x g]	(d) Without Project	(e) With Project	(f) Change Resulting from Project [e - d]	(g) Unit \$ Value	(h) Annual \$ Value [f x g]	(h) Total Annual Benefits (\$)	(i) Discount Value	(j) Discounted Benefits [h x i]
2009	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	1.000	\$0
2010	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.943	\$0
2011	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.890	\$0
2012	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.840	\$0
2013	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.792	\$0
2014	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.747	\$0
2015	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.705	\$0
2016	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.665	\$179,242
2017	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.627	\$0
2018	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.592	\$159,566
2019	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.558	\$0
2020	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.527	\$142,046
2021	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.497	\$0
2022	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.469	\$126,413
2023	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.442	\$0
2024	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.417	\$112,397
2025	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.390	\$0
2026	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.371	\$99,998
2027	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.350	\$0
2028	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.331	\$89,217
2029	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.312	\$0
2030	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.294	\$79,244
2031	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.278	\$0
2032	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.262	\$70,619
2033	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.247	\$0
2034	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.233	\$62,802
2035	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.220	\$0
2036	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.207	\$55,794
2037	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.196	\$0
2038	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.185	\$49,864
2039	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.174	\$0
2040	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.164	\$44,204
2041	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.155	\$0
2042	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.146	\$39,352
2043	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.138	\$0
2044	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.130	\$35,040
2045	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.123	\$0
2046	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.116	\$31,266
2047	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.109	\$0
2048	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.103	\$27,762
2049	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.097	\$0
2050	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.092	\$24,797
2051	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.087	\$0
2052	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.082	\$22,102
2053	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.077	\$0
2054	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.073	\$19,676
2055	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.069	\$0
2056	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.065	\$17,520
2057	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.061	\$0
2058	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.058	\$15,633
2059	0	0	0	\$214,863	\$0	0	0	0	\$54,674	\$0	\$0	0.054	\$0
2060	1	0	1	\$214,863	\$214,863	1	0	1	\$54,674	\$54,674	\$269,537	0.051	\$13,804
Total Present Value of Discounted Benefits over Project Life (Monetized Benefits):												\$1,518,358	
Project Allocation:												100.0%	
Total Present Value of Discounted Benefits (Monetized Benefits):												\$1,518,358	
Narrative description of benefits: Assumes 2-day storm event, followed by 5-day debris cleanup. Based on Redwood City Public Work Services Department personnel expenses.						Narrative description of benefits: Assumes 2-day storm event. Based on Redwood City Public Work Services Department personnel expenses, scaled up by 25% to incorporate higher salaries/benefits of safety personnel.							

Comments:

Table 20 - Proposal Project Cost and Benefit Summary for Proposition 1E (2009 dollars) Proposal: Bayfront Regional Drainage System Improvements and 5th Avenue Pump Station Renovation Project							
(a) Project	(b) Agency	(c) Total Present Value Project Costs	Total Present Value Project Benefits				(h) B/C Ratio [g / c]
			(d) Water Supply	(e) Flood Damage Reduction	(f) Other	(g) Total [d + e + f]	
Bayfront Regional Drainage System Improvements and 5th Avenue Pump Station Renovation Project	Redwood City	\$12,715,552	\$0	\$14,217,595	\$1,518,358	\$15,735,954	1.2375
TOTAL:		\$12,715,552	\$0	\$14,217,595	\$1,518,358	\$15,735,954	1.2375

** Multiple rows if proposal has several linked projects

